

# TEXAS INSTRUMENTS



12 October 1995

In Reply Refer to:  
234-231-1179  
Mail Station 61

Advanced Research Projects Agency (ARPA)  
Contracts Management Office (CMO)  
Virginia Square Plaza  
3701 North Fairfax Drive  
Arlington, VA 22203-1714

ATTENTION: Mr. Donald C. Sharkus

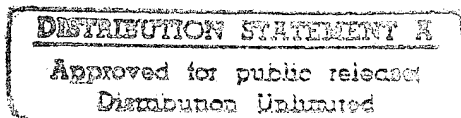
SUBJECT: Liquefied Metal Jet Program (LMJP)

REFERENCE: (a) Contract Number MDA972-93-C-0035, ARPA Order Number 9328/03

ENCLOSURES: (1) Deliverable Item Sequence Number 0002AA, R & D Quarterly Status Report, 15 July 1995 through 15 October 1995  
(2) Deliverable Item Sequence Number 0002AA, Program Financial Status Report, 15 July 1995 through 15 October 1995  
(3) Deliverable Item Sequence Number 0002AB, Quarterly Technical Report, 15 July 1995 through 15 October 1995

Sir:

Enclosures (1), (2), and (3) are submitted in accordance with reference (a) requirements. If you require technical information concerning this submittal, please contact R. E. Terrell at (214) 995-1094. If you require contractual information, please contact Al Naylor at (214) 995-3200.



Sincerely,

Laura Harvey  
Data Manager

cc: DSO - Dr. Richard T. Loda  
DSO - Dr. Ira D. Skurnick  
DSO - Ms. Claire P. Ricaurte  
DPRO/TI  
DTIC - Selections

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DTIC QUALITY INTEGRATED



**LIQUEFIED METAL JET PROGRAM  
AUTOMATION AND ROBOTICS  
RESEARCH INSTITUTE (ARRI)**

**R&D QUARTERLY STATUS REPORT**

**REPORTING PERIOD: 15 July 1995  
THROUGH 15 October 1995**

**Sponsored by:**

**Advanced Research Projects Agency (ARPA)  
Contract Management Office (CMO)  
Liquefied Metal Jet Program (LMJP)**

**ARPA Order No. 9328/03**

**Issued by: ARPA/CMO  
Under Contract No.: MDA972-93-C-0035**

**Deliverable Item Sequence No.: 0002AA**

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**Distribution Statement:**

**Approved for Public Release**

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**Prepared by:**

**Texas Instruments Incorporated  
Defense Systems & Electronics  
13532 North Central Expressway  
Dallas, Texas 75265**

**12 October, 1995**



<b>REPORT DOCUMENTATION PAGE</b>		<b>Form Approved QMB No. 0704-0188</b>	
Public reporting burden for this collection of information is estimated to average 110 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.			
1. Agency Use Only (Leave Blank)	2. Report Date October 12, 1995	3. Report Type and Dates Covered Quarterly Status Report	
4. Title and Subtitle <b>R &amp; D Quarterly Status Report</b>		5. Funding Numbers <b>C-MDA972-93-C-0035</b>	
6. Author(s) Mr. Nick Dringenburg, Dr. Charles Smith, Mr. Patrick DuBois, Mr. R.E. Terrill, and Dr. John Priest			
7. Performing Organization Name(s) and Address(es) Automation Robotic Research Institute Texas Instruments Inc 7300 Jack Newell Blvd. South P.O. Box 655012 Ft. Worth, TX 76118-7115 Dallas, TX 75265		8. Performing Organization Report Number 0002AA	
9. Sponsoring/Monitoring Agency Name(s) and Address(es) Advanced Research Projects Agency (ARPA) Contract Management Office (CMO) Virginia Square Plaza 3701 North Fairfax Drive Arlington, VA 22203-1714		10. Sponsoring/Monitoring Agency Report Number <b>ARPA Order Number 9328/03</b>	
11. Supplementary Notes			
12a. Distribution/Availability Statement Approved for Public Release; Distribution Unlimited		12b. Distribution Code	
13. Abstract (Maximum 200 words)  <b>This report covers the period from 15 July 1995 through 15 October 1995.</b>			
14. Subject Terms Liquefied Metal Jet (LMJ)		15. Number of Pages 4	
		16. Price Code	
17. Security Classification of Report UNCLASSIFIED	18. Security Classification of this Page UNCLASSIFIED	19. Security Classification of Abstract UNCLASSIFIED	20. Limitation of Abstract

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# **LIQUIFIED METAL JET PROGRAM (LMJP)**

## **AUTOMATION AND ROBOTICS RESEARCH INSTITUTE (ARRI)**

### **R&D QUARTERLY STATUS REPORT**

**DATA ITEM 0002AA**

**15 JULY 1995 THROUGH 15 OCTOBER 1995**

#### **1.0 INTRODUCTION**

This report covers the period from 15 July 1995 through 15 October 1995. The Quarterly Technical Reports are organized by the statement of work (SOW) listed in section 5.0 of the proposal. These are:

- Reports and demonstration
- Equipment
- System test and experimentation
- Test coupon evaluation
- Technology transfer.

Many significant technical issues have been overcome. Generation of test and evaluation coupons of 63/37 solder circuit patterns on copper coupons have been accomplished on the Phase I system. Final fabrication and assembly of the copper system has been completed, tested, and several attempts to generate copper spheres have been made.

#### **2.0 PROGRESS DURING THE REPORTING PERIOD**

- Generated solder circuit paths on copper substrates.
- Began evaluation of solder on copper coupons and etched solder on copper coupons
- Completed fabrication of copper system.
- Began testing and operations of copper system.

#### **3.0 PLANNED ACTIVITIES FOR NEXT REPORTING PERIOD**

- Demonstrate PWB fabrication capability to Industry.
- Produce higher quality solder coupons for evaluation.
- Demonstrate copper droplet formation.
- Develop white paper for ARPA to continue program.
- Final report and environmental impact study.

#### **4.0 EQUIPMENT PURCHASE OR CONSTRUCTED**

##### **Assembled/Constructed:**

- Completed fabrication and functional testing of copper system.
- Constructed and tested improved solder deflection system.

##### **Purchased:**

- None

#### **5.0 NOTIFICATION OF KEY PERSONNEL CHANGES**

None

#### **6.0 INFORMATION FROM TRIPS, MEETINGS, AND SPECIAL CONFERENCES**

- Progress report and sample coupons presented at the 1995 ECEM workshop.

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**LIQUEFIED METAL JET PROGRAM  
AUTOMATION AND ROBOTICS  
RESEARCH INSTITUTE (ARRI)  
R&D QUARTERLY STATUS REPORT  
PROGRAM FINANCIAL STATUS**

**REPORTING PERIOD: 15 July 1995  
THROUGH 15 October 1995**

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**ARPA Order No. 9328/03**

**Issued by: ARPA/CMO  
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**12 October, 1995**



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R & D STATUS REPORT  
PROGRAM FINANCIAL STATUS  
OCTOBER 1995

CUMULATIVE TO DATE				AT COMPLETION	
				\$1,127,684	
WORK BREAKDOWN TASK ELEMENT	PLANNED EXPEND	ACTUAL EXPEND	% COMPLETE	BAC*	IRE**
MANAGEMENT	1.0	98,109	87.97%	98,109	98,109
EQUIPMENT	2.0	814,187	108.35%	814,187	814,187
SYSTEM TEST & E	3.0	68,789	0.00%	68,789	68,789
SAMPLE EVALUATI	4.0	107,130	0.00%	107,130	107,130
TECHNICAL TRANS	5.0	39,469	0.00%	39,469	39,469
SUB-TOTAL		\$1,127,684	85.88%	\$1,127,684	\$1,127,684
FEE		71,470	100.00%	71,470	71,470
MANAGEMENT RESERVE UNALLOCATED RESOURCES					
TOTAL		\$1,199,154	86.73%	\$1,199,154	\$1,199,154

\*BUDGET AT COMPLETION (BAC) CHANGES ONLY WITH THE AMOUNT OF ANY SCOPE CHANGES.  
(NOT AFFECTED BY UNDERRUN OR OVERRUN).

\*\*LATEST REVISED ESTIMATE  
BASED ON CURRENTLY AUTHORIZED WORK:

- |     |  |     |
|-----|--|-----|
| (1) | IS CURRENT FUNDING SUFFICIENT FOR THE CURRENT FY?<br>(EXPLAIN IN NARRATIVE IF "NO").                             | YES |
| (2) | WHAT IS THE NEXT FISCAL YEAR'S FUNDING REQUIREMENT<br>AT CURRENT ANTICIPATED LEVELS?                             | 0   |
| (3) | HAVE YOU INCLUDED IN THE REPORT NARRATIVE ANY<br>EXPLANATION OF THE ABOVE DATA AND ARE THEY CROSS<br>REFERENCED? | NO  |